

WHAT IS CLAIMED IS:

1. An implantable cardioverter-defibrillator for subcutaneous positioning between the third rib and the twelfth rib within a patient, the implantable cardioverter-defibrillator comprising:

a housing, wherein the housing comprises a proximal end having a width and a distal end having a width and wherein the width of the distal end is less than the width of the proximal end;

an electrical circuit located within the housing; and

an electrode electrically coupled to the electrical circuit and located on the housing.

2. The implantable cardioverter-defibrillator of claim 1, wherein at least a portion of the distal end of the housing is rounded.

3. The implantable cardioverter-defibrillator of claim 1, wherein at least a portion of the proximal end of the housing is substantially square.

4. The implantable cardioverter-defibrillator of claim 1, wherein at least a portion of the proximal end of the housing is rounded.

5. The implantable cardioverter-defibrillator of claim 1, wherein the width of the proximal end of the housing is approximately 1 centimeter to approximately 10 centimeters wide.

6. The implantable cardioverter-defibrillator of claim 1, wherein the width of the proximal end of the housing is approximately 2 centimeters to approximately 5 centimeters wide.

7. The implantable cardioverter-defibrillator of claim 1, wherein the width of the distal end of the housing is approximately 1 centimeter to approximately 10 centimeters wide.

8. The implantable cardioverter-defibrillator of claim 1, wherein the width of the distal end of the housing is approximately 2 centimeters to approximately 5 centimeters wide.

20

9. The implantable cardioverter-defibrillator of claim 1, wherein the proximal end of the housing further comprises a

depth, wherein the depth of the proximal end of the housing is less than approximately 15 millimeters.

10. The implantable cardioverter-defibrillator of claim 1,
5 wherein the distal end of the housing further comprises a depth, wherein the depth of the distal end of the housing is approximately 1 millimeter to approximately 15 millimeters.

11. The implantable cardioverter-defibrillator of claim 1,
wherein the distal end of the housing further comprises a depth, wherein the depth of the distal end of the housing is approximately 1 millimeters to approximately 3 millimeters.

12. The implantable cardioverter-defibrillator of claim 1,
wherein the housing further comprises a length, wherein the length of the housing is approximately 3 centimeters to approximately 30 centimeters long.

13. The implantable cardioverter-defibrillator of claim 1,
20 wherein the housing further comprises a length, wherein the length of the housing is approximately 5 centimeters to approximately 20 centimeters long.

14. The implantable cardioverter-defibrillator of claim 1,
wherein the housing is substantially bilaterally symmetrical
along the housing's length.

5

15. The implantable cardioverter-defibrillator of claim 1,
wherein the proximal end of the housing is hinged to the distal
end of the housing.

10
15
20

16. The implantable cardioverter-defibrillator of claim 1,
wherein the proximal end of the housing is contiguous with the
distal end of the housing.

17. The implantable cardioverter-defibrillator of claim 1,
wherein at least a portion of the housing comprises an
electrically insulated material.

18. The implantable cardioverter-defibrillator of claim 1,
wherein at least a portion of the housing comprises an
20 electrically nonconductive material.

19. The implantable cardioverter-defibrillator of claim 1,
wherein the housing comprises a ceramic material.

20. The implantable cardioverter-defibrillator of claim 1,
5 wherein the housing comprises a titanium alloy.

21. The implantable cardioverter-defibrillator of claim 1,
wherein the housing comprises a polymeric material.

22. The implantable cardioverter-defibrillator of claim
21, wherein the polymeric material is selected from the group
consisting essentially of a polyurethane, a polyamide, a
polyetheretherketone (PEEK), a polyether block amide (PEBA), a
polytetrafluoroethylene (PTFE), a silicone, and mixtures
thereof.

23. The implantable cardioverter-defibrillator of claim 1,
wherein at least a portion of the housing is substantially non
planar.

24. The implantable cardioverter-defibrillator of claim 1, wherein at least a portion of the housing is substantially planar.

5 25. The implantable cardioverter-defibrillator of claim 1, wherein the electrical circuit can provide cardioversion-defibrillation for the patient's heart.

10 26. The implantable cardioverter-defibrillator of claim 25 wherein the electrical circuit can further provide multiphasic waveform cardiac pacing for the patient's heart.

15 27. The implantable cardioverter-defibrillator of claim 1, wherein the electrical circuit can provide multiphasic waveform cardiac pacing for the patient's heart.

28. The implantable cardioverter-defibrillator of claim 27, wherein the electrical circuit can provide biphasic waveform cardiac pacing for the patient's heart.

29. The implantable cardioverter-defibrillator of claim 27, wherein the electrical circuit can provide triphasic waveform cardiac pacing for the patient's heart.

5 30. The implantable cardioverter-defibrillator of claim 27, wherein the electrical circuit can further provide monophasic waveform cardiac pacing for the patient's heart.

10 31. The implantable cardioverter-defibrillator of claim 1, wherein the electrode can emit an energy for shocking the patient's heart.

15 32. The implantable cardioverter-defibrillator of claim 31, wherein the energy for shocking the patient's heart is approximately 50 joules to approximately 75 joules.

20 33. The implantable cardioverter-defibrillator of claim 31, wherein the energy for shocking the patient's heart is approximately 75 joules to approximately 100 joules.

34. The implantable cardioverter-defibrillator of claim 31, wherein the energy for shocking the patient's heart is approximately 100 joules to approximately 125 joules.

5 35. The implantable cardioverter-defibrillator of claim 31, wherein the energy for shocking the patient's heart is approximately 125 joules to approximately 150 joules.

36. The implantable cardioverter-defibrillator of claim 35, wherein the energy for shocking the patient's heart is approximately 150 J.

37. The implantable cardioverter-defibrillator of claim 31, wherein the electrode can receive sensory information.

38. The implantable cardioverter-defibrillator of claim 1, wherein the electrode can receive sensory information.

39. The implantable cardioverter-defibrillator of claim 1,
20 wherein at least a portion of the electrode is non-planar.

40. The implantable cardioverter-defibrillator of claim 1,
wherein the electrode is substantially circular in shape.

41. The implantable cardioverter-defibrillator of claim 1,
5 wherein the electrode is substantially ellipsoidal in shape.

42. The implantable cardioverter-defibrillator of claim 1,
wherein the electrode is substantially square in shape.

43. The implantable cardioverter-defibrillator of claim 1,
wherein the electrode is substantially rectangular in shape.

44. The implantable cardioverter-defibrillator of claim 1,
wherein the electrode is substantially triangular in shape.

45. The implantable cardioverter-defibrillator of claim 1,
wherein the electrode is substantially thumbnail shaped.

46. The implantable cardioverter-defibrillator of claim 1,
20 wherein the electrode is substantially spade shaped.

47. The implantable cardioverter-defibrillator of claim 1, wherein the housing further comprises a connection port electrically coupled to the electrical circuit.

5 48. The implantable cardioverter-defibrillator of claim 47, wherein the connection port is coupled to a lead.

49. The implantable cardioverter-defibrillator of claim 48, wherein the lead is a pacing lead.

50. The implantable cardioverter-defibrillator of claim 48, wherein the lead is a shocking lead.

51. The implantable cardioverter-defibrillator of claim 48, wherein the lead is a sensory lead.

52. A duckbill-shaped implantable cardioverter-defibrillator comprising:

a main housing member having a length, a width and a depth;
a distal housing member extending proximally from the main
20 housing member, wherein the distal housing member has a length,
a width and a depth;

56. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the proximal housing member is in fluid communication with the main housing member.

5 57. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the proximal housing member is contiguous with the main housing member.

58. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the distal housing member is hinged to the main housing member.

59. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the distal housing member further includes a distal end, wherein at least a portion of the distal end of the distal housing member is curved.

60. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the main housing member 20 further includes a proximal end, wherein at least a portion of the proximal end of the main housing member is substantially square.

61. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the main housing member further includes a proximal end, wherein at least a portion of 5 the proximal end of the main housing member is rounded.

62. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the width of the main housing member is approximately 3 centimeters to approximately 30 centimeters wide.

63. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the main housing member is approximately 3 centimeters to approximately 20 centimeters wide.

64. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the distal housing member further comprises a shoulder region, wherein the shoulder region 20 extends distally from the main housing member.

65. The duckbill-shaped implantable cardioverter-defibrillator of claim 64, wherein the shoulder region of the distal housing member has a width that is less than the width of the main housing member.

5

66. The duckbill-shaped implantable cardioverter-defibrillator of claim 65, wherein at least a portion of the width of the shoulder region decreases as the shoulder region extends distally from the main housing member.

67. The duckbill-shaped implantable cardioverter-defibrillator of claim 66, wherein the width of the shoulder region decreases proportionally as the shoulder region extends distally from the main housing member.

20 the distal housing member.

69. The duckbill-shaped implantable cardioverter-defibrillator of claim 68, wherein the distal head of the distal housing member has a width that is less than the width of the shoulder region of the distal housing member.

5

70. The duckbill-shaped implantable cardioverter-defibrillator of claim 68, wherein the distal head of the distal housing member has a width that is greater than the width of the shoulder region of the distal housing member.

PCT/US2003/018630

71. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the depth of the distal housing member is less than the depth of the main housing member.

20

72. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the depth of the distal housing member is less than approximately 15 millimeters.

73. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the depth of the main housing

member is approximately 1 millimeter to approximately 15 millimeters.

74. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the depth of the main housing member is approximately 1 millimeter to approximately 10 millimeters.

75. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein at least a portion of the distal housing member is substantially non-planar.

76. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein at least a portion of the main housing member is substantially planar.

77. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein at least a portion of the main housing member is substantially non-planar.

78. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the distal housing member is bilaterally symmetrical along its length.

5 79. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein at least a portion of the distal housing member comprises an electrically insulated material.

80. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein at least a portion of the distal housing member comprises an electrically nonconductive material.

81. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the main housing member comprises a ceramic material.

82. The duckbill-shaped implantable cardioverter-
20 defibrillator of claim 52, wherein the main housing member comprises a titanium alloy.

83. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the main housing member comprises a stainless steel alloy.

5 84. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the main housing member comprises a polymeric material.

15 85. The duckbill-shaped implantable cardioverter-defibrillator of claim 84, wherein the polymeric material is selected from the group consisting essentially of a polyurethane, a polyamide, a polyetheretherketone (PEEK), a polyether block amide (PEBA), a polytetrafluoroethylene (PTFE), a silicone, and mixtures thereof.

20 86. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the electrical circuit can provide cardioversion-defibrillation for the patient's heart.

87. The duckbill-shaped implantable cardioverter-defibrillator of claim 86, wherein the electrical circuit can

provide multiphasic waveform cardiac pacing for the patient's heart.

88. The duckbill-shaped implantable cardioverter-
5 defibrillator of claim 52, wherein the electrical circuit can provide multiphasic waveform cardiac pacing for the patient's heart.

89. The duckbill-shaped implantable cardioverter-
10 defibrillator of claim 88, wherein the electrical circuit can provide biphasic waveform cardiac pacing for the patient's heart.

90. The duckbill-shaped implantable cardioverter-
defibrillator of claim 88, wherein the electrical circuit can provide triphasic waveform cardiac pacing for the patient's heart.

91. The duckbill-shaped implantable cardioverter-
20 defibrillator of claim 52, wherein the electric circuit can provide monophasic waveform cardiac pacing for the patient's heart.

92. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the electrode can emit an energy for shocking the patient's heart.

5

93. The duckbill-shaped implantable cardioverter-defibrillator of claim 92, wherein the energy for shocking the patient's heart is approximately 50 joules to approximately 75 joules.

10 94. The duckbill-shaped implantable cardioverter-defibrillator of claim 92, wherein the energy for shocking the patient's heart is approximately 75 joules to approximately 100 joules.

15 95. The duckbill-shaped implantable cardioverter-defibrillator of claim 92, wherein the energy for shocking the patient's heart is approximately 100 joules to approximately 125 joules.

20 96. The duckbill-shaped implantable cardioverter-defibrillator of claim 92, wherein the energy for shocking the

patient's heart is approximately 125 joules to approximately 150 joules.

97. The duckbill-shaped implantable cardioverter-
5 defibrillator of claim 96, wherein the energy for shocking the patient's heart is approximately 150 J.

98. The duckbill-shaped implantable cardioverter-
defibrillator of claim 92, wherein the electrode can receive sensory information.

99. The duckbill-shaped implantable cardioverter-
defibrillator of claim 52, wherein the electrode can receive sensory information.

100. The duckbill-shaped implantable cardioverter-
defibrillator of claim 52, wherein at least a portion of the electrode is non-planar.

101. The duckbill-shaped implantable cardioverter-
20 defibrillator of claim 52, wherein the electrode is substantially circular in shape.

102. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the electrode is substantially ellipsoidal in shape.

5 103. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the electrode is substantially square in shape.

10 104. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the electrode is substantially rectangular in shape.

15 105. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the electrode is substantially triangular in shape.

20 106. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the electrode is substantially thumbnail shaped.

107. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the electrode is substantially spade shaped.

5 108. The duckbill-shaped implantable cardioverter-defibrillator of claim 52, wherein the main housing member further comprises a connection port that electrically couples to the electrical circuit.

10 109. The duckbill-shaped implantable cardioverter-defibrillator of claim 108, wherein the connection port is coupled to a lead.

15 110. The duckbill-shaped implantable cardioverter-defibrillator of claim 109, wherein the lead is a pacing lead.

111. The duckbill-shaped implantable cardioverter-defibrillator of claim 109, wherein the lead is a shocking lead.

20 112. The duckbill-shaped implantable cardioverter-defibrillator of claim 109, wherein the lead is a sensory lead.

113. A method of inserting an implantable cardioverter-defibrillator within a patient, the method comprising the steps of:

providing a duckbill-shaped cardioverter-defibrillator comprising a housing, an electrical circuit located within the housing, and an electrode located on the housing, wherein the duckbill-shaped cardioverter-defibrillator is configured to maintain the electrode in a predetermined relationship subcutaneously over a patient's ribcage;

making a single incision on a patient's thorax; and

advancing the duckbill-shaped cardioverter-defibrillator through the single incision and subcutaneously over a patient's ribcage.

114. The method of claim 113, wherein the housing comprises a proximal end having a width and a distal end having a width and wherein the width of the distal end is less than the width of the proximal end.

20 115. The method of claim 114, wherein at least a portion of the distal end of the housing is rounded.

116. The method of claim 114, wherein at least a portion of the proximal end of the housing is substantially square.

117. The method of claim 114, wherein at least a portion of 5 the proximal end of the housing is rounded.

118. The method of claim 114, wherein the width of the proximal end of the housing is approximately 1 centimeter to approximately 10 centimeters wide.

119. The method of claim 114, wherein the width of the proximal end of the housing is approximately 2 centimeters to approximately 5 centimeters wide.

120. The method of claim 114, wherein the width of the distal end of the housing is approximately 1 centimeter to approximately 10 centimeters wide.

121. The method of claim 114, wherein the width of the 20 distal end of the housing is approximately 2 centimeters to approximately 5 centimeters wide.

122. The method of claim 114, wherein the proximal end of the housing further comprises a depth, wherein the depth of the proximal end of the housing is less than approximately 15 millimeters.

5

123. The method of claim 114, wherein the distal end of the housing further comprises a depth, wherein the depth of the distal end of the housing is approximately 1 millimeter to approximately 15 millimeters.

124. The method of claim 114, wherein the distal end of the housing further comprises a depth, wherein the depth of the distal end of the housing is approximately 1 millimeter to approximately 3 millimeters.

125. The method of claim 113, wherein the housing further comprises a length, wherein the length of the housing is approximately 3 centimeters to approximately 30 centimeters long.

20

126. The method of claim 113, wherein the housing further comprises a length, wherein the length of the housing is

approximately 5 centimeters to approximately 20 centimeters long.

127. The method of claim 113, wherein the housing is substantially bilaterally symmetrical along the housing's length.

128. The method of claim 114, wherein the proximal end of the housing is contiguous with the distal end of the housing.

129. The method of claim 113, wherein at least a portion of the housing comprises an electrically insulated material.

130. The method of claim 113, wherein at least a portion of the housing comprises an electrically nonconductive material.

131. The method of claim 113, wherein the housing is substantially non planar.

20 132. The method of claim 113, wherein the housing is substantially planar.

133. The method of claim 133, wherein the electrical circuit can provide cardioversion-defibrillation for the patient's heart.

5 134. The method of claim 133, wherein the electrical circuit can further provide multiphasic waveform cardiac pacing for the patient's heart.

135. The method of claim 113, wherein the electrical circuit can provide multiphasic waveform cardiac pacing for the patient's heart.

136. The method of claim 135, wherein the electrical circuit can provide biphasic waveform cardiac pacing for the patient's heart.

137. The method of claim 135, wherein the electrical circuit can provide triphasic waveform cardiac pacing for the patient's heart.

138. The method of claim 113, wherein the electrical circuit can provide monophasic waveform cardiac pacing for the patient's heart.

5 139. The method of claim 113, wherein the electrode can emit an energy for shocking the patient's heart.

140. The method of claim 139, wherein the electrode can receive sensory information.

141. The method of claim 113, wherein the electrode can receive sensory information.

142. The method of claim 113, wherein at least a portion of the electrode is non-planar.

143. The method of claim 113, wherein the single incision is made approximately at the level of the cardiac apex.

20 144. The method of claim 113, wherein the single incision is made approximately in the left anterior axillary line.

145. The method of claim 113, wherein the duckbill-shaped cardioverter-defibrillator is advanced proximate the patient's heart.

5 146. The method of claim 113, wherein the duckbill-shaped cardioverter-defibrillator is advanced medially toward approximately a patient's left inframmary crease.

147. The method of claim 113, wherein the duckbill-shaped cardioverter-defibrillator is advanced proximate a patient's sternum.

148. The method of claim 113, wherein the duckbill-shaped cardioverter-defibrillator is advanced approximately between a patient's third and a patient's twelfth rib.

149. The method of claim 113, wherein the duckbill-shaped cardioverter-defibrillator refrains from directly contacting the patient's heart.

150. The method of claim 113, wherein the duckbill-shaped cardioverter-defibrillator refrains from directly contacting the patient's intrathoracic vessels.